Regional Structure, Growth and Convergence of Income in Maharashtra

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Abstract

Evolutions of spatial economies are marked by complexities. An economy may have a higher rate of growth at the aggregate level but, simultaneously, the regional ‘trickle down effect’ or ‘distributive effect’ of the economy can be very weak. In the evolution process, it may so happen that regions may converge at one ‘spatial scale’ but can be diverging at another spatial scale, or there may be marked presence of ‘convergence clubs’. This argument is well illustrated by regional economies of India. Studies have shown that State economies in India are diverging, and the rate of divergence has increased in the ‘post-reform’ period. However, the present study, which analyses the sectoral and aggregate per capita incomes in Maharashtra suing **spatial econometric methods** for the period 1993-94 to 2002-03, shows that opposed to the trend of divergence at inter-State level, regional economies in Maharashtra are converging, though with significant differences in the rates of convergence across various sectors and regions. Marathwada and Vidarbha, with weak industrial sectors, have been the most underdeveloped regions in the State over the years. The study also highlights the impact of ‘spatial spillovers’ on regional patterns of economic development in the State and its policy implications.

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I. Introduction

Maharashtra has been one of the leading States in terms of per capita income in the country over the years. The success of this States vis-à-vis other States in the country can be attributed to its consistent liberal economic policy. In per capita income, the State ranked second, after Punjab in 1993-94, and again occupied second rank in 2003-04, after Gujarat. The liberal economic policy and conducive environment for industries and commerce has led to the transformation of composition of State income and regional economies over the years. The tertiary sector income, which constituted 40% of the State income in 1960-61, has increased to 61% (at current prices) in 2003-04; the contribution of primary sector has declined from 34% to 13% during the same period, while the share of secondary sector has remained constant, i.e. 26%. In comparison to Maharashtra, the contribution of tertiary, secondary and primary sectors in the national income in 2003-04, was 53%, 22% and 25% respectively (Govt. of Maharashtra, 2004-05).

Notwithstanding the overall higher economic growth and development in the State, all is not well with its economy as paranoia for economic growth and generation of wealth has led to the relative neglect of its distributional aspects. It has frequently been stated that take out Gr. Mumbai, and Pune Division, the rest of Maharashtra would not be better than 'BIMARU' States. Demand for a separate state of Vidarbha on the basis of its low development and urge for more allocation of financial resources for developments of Marathwada can be seen the above context.

The present paper attempts to examine the trends in regional inequalities in sectoral as well as aggregate per capita income in Maharashtra. More specifically, it attempts, (1) to find out regional structures of income, and composition of regional income in the State of Maharashtra (regions being defined in terms of districts and groups of districts), (2) to examine inter-regional and inter-sectoral differences in growth rate of income, (3) to analyse level and trends in regional income inequality, (4) to explore the relationship between trends in spatial associations and regional inequality, and (5) to find out regional convergence/divergence and spatial spillover process in the State.

The paper is divided into VI Sections. Section II deals with data and methodology used in the study. It also briefly discusses the limitation of conventional econometric methods in analyzing spatial data and how spatial econometric methods have advantage over the conventional methods. Sectoral composition of regional incomes and their growth are examined in Section III, and an analysis of regional inequality in income is presented in Section IV. Section IV also highlights the relationship between trend in regional inequality and spatial associations. Convergence of regional income and spatial spill-over process through simulation are examined in Section V. The last Section presents summary and conclusions.

II. Data and Methodology

Directorate of Economics and Statistics, Govt. of Maharashtra, Mumbai has compiled districtwise 'Net Domestic Product' for the State from 1993-94 onwards. The latest year for which the data are available is 2002-03. This ten-year data (1993-94 to 2002-03) for the districts in the State have been used in the present study. There were 30 districts in the States in 1993-94, and since then five new districts have been created. In order to maintain comparability of the data of spatial units, the data for newly created districts have been clubbed with their parent districts. To analyse regional inequality and convergence, various statistical methods, besides 'different ratios and proportions', have been used. Some of these methods are briefly presented below:

Measures of Regional Inequality

To measure district level inequality in per capita income, the Gini Coefficient, Theil's Inequality Index (global and decomposed), and Coefficient of Variation (CV) have been used.

Gini Coefficient is derived from the Lorenz curve. There are several ways to compute the Gini Coefficient for a dataset. Present study uses the following formula to calculate the Gini Coefficient (G).

$$G = \sum_{i-1}^{n} (2i - n - 1) x_i^{'} \Big/ n^2 \mu \qquad \ldots(1)$$

Where, *i* is the individual's rank order number, *n* is the number of total individuals, $x_i^{'}$ is the individual's value, and μ is the population average. The Gini coefficient is a full-information measure, looking at all parts of the distribution. *G* ranges between zero and 1: a zero shows perfect equality among regions/individuals and 1 indicates that all development is concentrated to only one region/individual. It facilitates direct comparison between two populations regardless of their sizes.

Among regional inequality measures, another preferred method is *Theil's Index of Inequality* (*T*) as it allows easy decomposition of total inequality between and within regions. *T* is computed as follows (Rey, 2001):

$$T = \sum_{i=1}^{n} s_i \ln(n s_i) \qquad \ldots(2)$$

Where, n is the number of regions, y_i is the variable in question in regions i, and

$$s_i = y_i \Big/ \sum_{i=1}^{n} y_i \qquad \ldots(3)$$

The decomposition property of *T* has been exploited to investigate the extent to which global inequality is attributable to inequality 'between' or 'within' regional grouping. By partitioning the *n* spatial observations into ω mutually exclusive and exhaustive groups, *T* can be decomposed as follows:

$$T = \sum_{g=1}^{\omega} s_g \ln(n / n_g s_g) + \sum_{g=1}^{\omega} \sum_{i \in g} s_{i,g} \ln(n_g s_{i,g}) \qquad \ldots(4)$$

Where, n_g is the number of observations in group g (and $\sum_g n_g = n$), $s_g = \sum_{i=g} y_{i,g} \Big/ \sum_{i=1}^{n} y_i$ is the share of total value of the variable y accounted for by group g, and $s_{i,g} = y_{i,g} \Big/ \sum_{i=1}^{n_g} y_{i,g}$ is region i's share of group g's value.

The first term on the right hand side of the above equation is the 'between-group' (T_B) component of inequality, while the second term is the 'within-group' group (T_W) component of inequality. In other words:

$$T = T_B + T_W \qquad \ldots(5)$$

In spatial context, the within-group term measures intraregional inequality, while the between-group component captures interregional inequality. In other words, the interregional term measures the distance between the mean values of the aggregate groups, while the intraregional term measures distance between the values of units belonging to the same region.

Measure of Spatial Autocorrelation: Moran's I

Spatial autocorrelation can be defined in terms of value similarity with locational similarity (Anselin & Bera, 1998). Positive spatial autocorrelation occurs when similar value for a variable are clustered together, and negative spatial autocorrelation appears when dissimilar values are clustered in space. Although various methods have been proposed to measure the spatial autocorrelation, the present study uses Moran's *I* statistics, which is most widely used measure of spatial autocorrelation. The Moran's *I* is computed as follows:

$$I = \left(\frac{n}{s_0}\right) \frac{\sum_{i=1}^{n} \sum_{j=1}^{n} w_{ij} x_j}{\sum_{i=1}^{n} x^2} \qquad \ldots(6)$$

Where n is the number of observations, w_{ij} is the element in spatial weight matrix w corresponding to the region (i,j), the observations x_i and x_j are in deviation from their mean values for region i and j, respectively, and s_0 is the normalising factor equal to the sum of the elements of the weight matrix, i.e., $s_0 = \sum_i \sum_j w_{ij}$ (Anselin, 1992).

Different definitions of interaction between regions cause different spatial weight matrices. The study adopts the simplest but most powerful the binary contiguity matrix, where the element (i,j) of the spatial weight matrix, wij =1 if region i and j share a border, and zero otherwise (Anselin, 1992; Hanning, 1990; Upton and Fingleton, 1985). When the spatial weight matrix is row standardised such that sum of each row equals 1, the expression (Lim, 2003) given above simplifies to:

$$I = \frac{\sum_{i=1}^{n} \sum_{j=1}^{n} w_{ij} x_i x_j}{\sum_{i=1}^{n} x^2} \qquad \ldots(7)$$

or, in matrix notation:

$$I = \frac{\mathbf{x}'\mathbf{w}\mathbf{x}}{\mathbf{x}'\mathbf{x}} \qquad \ldots(8)$$

Where, $\mathbf{w}$ is a spatial weight matrix and $\mathbf{x}$ is vector of observed value in deviation from the mean. The value of Moran's I ranges between -1 and +1. Negative value of Moran's I shows negative spatial autocorrelation and vice versa. When spatial weight matrix is row standardardised, the spatial lag value of region is equal to the mean value of the neighbouring regions.

If regions with similar values/per capita income are clustered together, the positive spatial autocorrelation is observed, and if the arrangement of spatial units in geographic space is such that they form check-board pattern, a negative spatial autocorrelation is the outcome. Comparing the spatial autocorrelation in per capita income for each year, the study traces the trajectory of regional dynamics and distribution patterns of income over time.

In order to have more disaggregated view of spatial autocorrelation/association, the *Moran Scatter Plot* suggested by Anselin (1996), has been used to capture the local structure of spatial associations. Since the elements in the vector $\mathbf{x}$ in the above equation are deviations from the mean, the Morna's I statistics is formally equivalent to the slope coefficient in the linear regression of spatial lag $\mathbf{wx}$ on $\mathbf{x}$. With the help of Moran scatter plot, one can decompose the global spatial association into four different quadrants, which correspond to four different kinds of local spatial associations between a region and its neighbour. These four quadrants and association types are: (1) High-High: regions with high per capita income surrounded by other regions with high per capita income (quadrant I); (2) Low-High: regions with low per capita income surrounded by regions with high per capita income (quadrant II); (3) Low-Low: regions with low per capita income surrounded by other regions with low per capita income (quadrant III); (4) High-Low: regions with high per capita income surrounded by regions with low per capita income (quadrant IV). Quadrants I and III represent positive spatial association indicating clustering of regions with similar values, while quadrants II and IV show negative spatial association or clustering of regions with dissimilar values (Lim, 2003).

Regression Analysis

A conventional 'ordinary least square' (OLS) regression equation can be stated as,

$$\mathbf{y} = \boldsymbol{\alpha} + \boldsymbol{\beta}\mathbf{X} + \boldsymbol{\varepsilon} \quad \ldots(9)$$

where $\mathbf{y}$ shows a vector of dependent variable, and $\mathbf{X}$ presents independent variables. The above equation assumes that random error terms, $\boldsymbol{\varepsilon}$, is normally distributed with zero mean and homoscedastic variance σ^2.

However, in the above equation, there are no parameters which take care of spatial effects or spatial autocorrelation in the data. The equation treats regions as 'isolated islands' (Quah, 1996). It does not capture the fact the one region's economic destiny is dependent upon those of other regions. Indeed, the evolution of each region is closely related to the evolution of, at least, neighbouring regions. We, therefore, assume that regional distribution of income is unlikely to be spatially independent and random. When models are estimated for cross-sectional data on spatial units, the lack of independence across these units can cause serious problem of model misspecification when ignored (Anselin, 1988; Lim, 2003). Three kinds of models/specifications can be used to deal with spatial dependence of observations: The *spatial lag* model, the *spatial error* model, and *spatial cross-regressive* model (Rey and Montouri, 1999; Anselin, 1988; Anselin and Bera, 1998).

In spatial lag model, substantive spatial dependence (through sptial externalities and spillover effects) is incorporated through a spatially lagged dependent variable:

$$\mathbf{y} = \boldsymbol{\alpha} + \boldsymbol{\beta} \ln \mathbf{X} + \boldsymbol{\rho} \mathbf{w} \mathbf{y} + \boldsymbol{\varepsilon} \qquad \ldots(10)$$

where, $\boldsymbol{\rho}$ is a scalar spatial autoregressive coefficient, $\mathbf{wy}$ is spatial lagged dependent variable for a spatial weight matrix $\mathbf{w}$. Thus, in this model the resulting per capita income in a region is also considered to be dependent on per capita income in its neighbouring region. Ordinary Least Square (OLS) estimator of the this model yields biased and inconsistent estimates for the coefficients due to the simultaneity between the error term and the spatially lagged variable. Therefore, alternative estimators based on maximum likelihood (ML) and instrumental variables have been suggested for the estimation for consistent results (Anselin, 1988; Anselin and Bera, 1998). The paper uses ML estimate of this model.

The *spatial error* model is applied when spatial dependence is expected working though the error process which can result from measurement problem (Rey and Montouri, 1999). Spatial error dependence may be interpreted as a 'nuisance' in that it reflects spatial autocorrelation in measurement errors in variables that are otherwise not crucial for the model. The spatial process pertaining to error term can be expressed as (Lim, 2003; Rey and Montouri, 1999):

$$\boldsymbol{\varepsilon} = \boldsymbol{\lambda} \mathbf{w} \boldsymbol{\varepsilon} + \boldsymbol{\xi}$$
$$\boldsymbol{\varepsilon} = (\mathbf{I} - \boldsymbol{\lambda} \mathbf{w})^{-1} \boldsymbol{\xi} \qquad \ldots(11)$$

where $\boldsymbol{\varepsilon}$ is a vector error terms, $\boldsymbol{\lambda}$ is a spatial error coefficient. $\boldsymbol{\xi}$ is a vector of error terms which is normally distributed with zero mean and homoscedastic variance σ_{ξ}^{2}.

Including the spatial autocorrelation of the error terms, the above given regression model becomes:

$$\mathbf{y} = \boldsymbol{\alpha} + \boldsymbol{\beta}\mathbf{X} + (\mathbf{I} - \boldsymbol{\lambda}\mathbf{w})^{-1}\boldsymbol{\xi} \qquad \text{...(12)}$$

OLS estimator will again give biased estimates of the parameters' variance. Therefore, spatial error model is estimated with ML method (Anselin, 1988; Anselin and Bera, 1998). From the equation (12) it is evident that a random shock introduced into a specific district will not only affect the growth rate in that district, but through spatial transformation ($(\mathbf{I} - \boldsymbol{\zeta}\mathbf{W})^{-1}$, will impact the growth rate of other districts as well. The inverse operator in the transformation defines an error covariance structure that diffuses district specific shocks not only to the district's neighbours but throughout the system (Rey and Montouri, 1999).

In spatial cross-regressive model spatial effect is dealt with introduction of spatial lag variable of explanatory variable $\mathbf{wX}$ (Rey and Montouri, 1999), and, thus, the regression model becomes:

$$\mathbf{y} = \boldsymbol{\alpha} + \boldsymbol{\beta}\mathbf{X} + \tau\mathbf{wy} + \varepsilon \qquad \text{...(13)}$$

This specification implies that per capita income in a region is affected not only by independent variables, but also the spatial lag of independent variables. As the spatially lagged explanatory variable is exogenous, estimation of spatial cross-regressive model can be based on OLS (Rey and Montouri, 1999).

Geographically Weighted Regression: Spatially Drifting β-coefficients

Regression establishes relationship among dependent variable and a set of independent variable(s). When usual regression methods are applied to spatial data, it is assumed that there exist stationary spatial process. However, spatial data are seldom stationary. When spatial non-stationarity exists, the same stimulus or shock produces different response in different parts of the study region. The non-stationarity may emerge due to: (i) sampling variation – called nuisance variation or not real spatial non-stationarity, (ii) relationship intrinsically different across space – real spatial non-stationarity, and (iii) model misspecification. If non-stationary data is modelled with stationary model, the consequent may be (i) wrong conclusions are drawn, and (ii) the residuals of the model might be highly autocorrelated.

In global models, spatial processes are assumed to be stationary and as such are location independent. The local models like spatial expansion method (Casetti, 1972; 1997; Jones and Casetti, 1992), and geographically weighted regression (GWR) model decompose the global model and produce results which are location dependent. These models are based on first law of geography: 'every thing is related to everything else, but closer things are more related'. These models address the spatial/geographical non-stationarity directly as they allow relationship to vary over space, i.e., regression coefficients need not be the same everywhere over the space. The expansion model suggested by Casetti (1972, 1997) suffers from some limitations like: (i) the technique has been restricted to displaying trends in relationships over space with the complexity of measured trends being dependent upon the complexity of expansion equations, and, therefore, the spatially varying parameters obtained through the expansion method might obscure important local variations to the broad trends represented by the expansion equations; (ii) the form of expansion equations needs to be assumed a priori; (iii) the expansion equations must be deterministic to remove problems of estimation in the terminal model (Fotheringham, Brusdon, and Charlton, 2002). All these problems are overcome by GWR. We, therefore, have used GWR in our analysis for detecting spatial heterogeneity and patterns in regression parameters.

In the regular OLS model, regression parameters at i*th* location are estimated by:

$$\boldsymbol{\beta} = (\mathbf{X}'\mathbf{X})^{-1}\mathbf{X}'\mathbf{Y} \qquad \ldots(14)$$

In GWR, they are given by (Lee, 2004):

$$\boldsymbol{\beta} = (\mathbf{X}'\mathbf{W}_i\mathbf{X})^{-1}\mathbf{X}'\mathbf{W}_i\mathbf{Y} \qquad \ldots(15)$$

Where, $\mathbf{X}$ and $\mathbf{Y}$ are independent and dependent variables respectively, and $\mathbf{W}_i$ is an n-by-n local weight matrix, whose off-diagonal elements are zero and diagonal elements denote the geographical weighting of observed data for point/region i . That is

$$\mathbf{W}_i = \begin{bmatrix} w_{i1} & 0 & \cdots & 0 \\ 0 & w_{i2} & \cdots & 0 \\ \vdots & \vdots & \cdots & \vdots \\ 0 & 0 & \cdots & w_{in} \end{bmatrix} \quad \ldots(16)$$

Where, $\boldsymbol{w}_{in}$ denotes the weight of the data at point n on the calibration of the model around point i. These weights will vary over space with i which distinguishes GWR from traditional weighted least square, where the weighting matrix is constant. The study uses Gaussian weighting method.

III. Regional and Sectoral Distribution of Income and its Growth.

Regional shares of aggregate and sectoral income in Maharashtra presented in Table 1 for the year 1993-94 and 2002-03 show the following: (1) The economic development in the State is highly polarized and metropolitised as about two-fifth of the Net State Income comes from Konkan; also four highly urbanized districts- Mumbai, Thane, Pune and Nagpur account for about one-half of the NSDP. (2) Not only the four major urbanized districts just mentioned also account for more than 55% of the tertiary sector income, but Konkan region alone accounts for about 46% of this sector. (3) There has been significant dispersal of industrial activities from Konkan to other regions in the State. (4) Whereas shares of other regions in primary sector income have stagnated or declined, there has been significant increase of the share of Western Maharashtra in this sector. (5) Although there have been marginal increase in the shares of the four highly urbanised districts in NSDP over the years, inter-district inequalities in sectoral as well as aggregate income have declined in 2002-03 in comparison to 1993-94.

[Table 1 about here]

Konkan region has had a significantly high share of the State income over the years. The region accounts for about 25% of the State population, but its share in State's income has been more than 40%. Table 2 shows that as against per capita State income of Rs.12,326 and Rs.15,484 in 1993-94 and 2002-03, the region had had per capita income of

Rs.20,424 and Rs.23,938, respectively, in the same years. Although, Konkan is highly developed region in the State, spatially polarized developments in the region are also glaring. The development has been concentrated in Greater Mumbai, Thane and Raigad, while Ratnagiri and Sindhudurg districts in the region have been as worse off as any backward districts of Vidharbha or Marathawada. As expected, the highest developed district in the region (and also in the State) has been Gr. Mumbai, with per capita income of Rs.24,382 in 1993-94 and Rs.32,402 in 2002-03, while Ratnagri, the least developed district in the region, has had per capita income of only Rs.8,888 and Rs.11,850, respectively, in the same years. Although Gr. Mumbai has been the highest developed district in the State over the years, it should also be kept in mind that about a half of the population in the district/metropolis lives in slums with scanty provisions of drinking water, sanitation, health, hygiene, housing, etc.; literally five to six million people live next to latrines, on pavements, plinths, platforms, and have no access to anything called civic amenities (Desarda, 1996).

[Table 2 about here]

After the Konkan region, Western Maharashtra is the second most economically developed region in the State. However, the region has had lower total per capita than the State average over the years (Table 2). The Western Maharashtra comprised of two Divisions, namely Nashik and the Pune Divisions. As evident from Table 2, this region too has not escaped from polarized development. It is Pune Division in the region where most of the economic development is concentrated, and situation in Nashik Division is not very different from Vidarbha or Marathwada region. In fact, Dhule and Ahmednagar districts in Nashik Division ranked 30th (the last) and 22nd in terms of total per capita income among 30 districts in the State in 1993-94. The ranking of these two districts has relatively improved in 2003-04 but they still occupy low ranks, that is 24th and 18th , respectively. The ranking of all the districts in terms of total per capita income in Western Maharashtra has improved over the years. Pune, which was 4th most developed district in the State in 1993-94, has become the 2nd most developed district in 2002-03. The other districts, which have experienced significant upward mobility in their ranks, are Satara, Sangli and Jalgaon.

Among the four major regions in the State, Vidarbha has been the 3rd most developed region, while the least developed region has been the Marathwada. In fact, this pattern of development ranking has been consistent over years, and other studies which even have taken many other aspects into considerations while computing development ranks for the regions also show the same regional ranking/development pattern (see Govt. of Maharashtra, 2002; Govt. of Maharashtra, 1984; Prabhu and Sarker, 2003; Prabhu and Sarker, 1992; Shaban and Bhole, 1997). The per capita income in Vidarbha and Marathwada was Rs.9,801 and Rs.8,035 in 1993-94, and Rs.11,876 and Rs.9,498, respectively, in 2002-03. As expected, except Nagpur, which ranked 5th and 4th respectively in the two reference years, the ranks of other districts have been very low. The ranks of four districts (Gadchiroli, Chandrapur, Amravati and Akola), out of the total nine districts in Vidarbha, and three districts (Aurangabad, Parbhani and Latur) in Marathwada out of the total seven districts in the region, have experienced decline in their ranks. Gadchiroli in Vidarbha, which was 7th most developed district in the State in 1993-94, has become the least developed district in 2003-04. In fact, the district has experienced decline in per capita income from Rs.11,784 in 1993-94 to Rs.6,453 in 2002-03. Besides Gadchiroli, the only other district, which experienced decline in per capita income in the State, is Raigad. In Raigad, the per capita income has declined from Rs.20,245 to Rs.16,009 during the above mentioned period. In case of Gadchiroli, the decline of income is due to decline of primary sector, while in case of Raigad it is due to flight of (registered) industries. The contribution of registered manufacturing in Net District Domestic Product of Raigad was Rs.2331 crore in 1993-94, which declined to Rs.1151 crore in 2002-03. Due to development of Navi Mumbai, and imposition of various punitive taxes & restrictions, such as high property taxes, high water charges and implementation of environmental regulation etc., has resulted in flight of many industries from the vicinity of Mumbai and Navi Mumbai. Among other things, increased cost of labour and land has also contributed to this industrial flight and closures.

The State of Maharashtra has had highly metropolitised economy. The four highly urbanised districts, Greater Mumbai, Thane, Pune and Nagpur accounted for about 48% of NSDP in 1993-94 and 50% in 2002-03. Thus, this metropolitisation of the State economy has increased over the years. The share of Greater Mumbai in the NSDP has increased from 24.8% in 1993-94 to 25.7% in 2002-03. The shares of Thane, Pune and Nagpur have marginally increased from 9.6%, 8.6% and 4.6% to 9.9%, 9.6% and 4.7%, respectively, during the reference period. In comparison to their shares in the State income, these four districts together accounted for only 30.4% and 32.7% of total population in the State in 1993-94 and 2002-03, respectively. As expected economic liberalization has further contributed in accentuating the polarized and metropolitised development in the State, and this needs to be overcome.

The share of tertiary sector in the State income has significantly increased over the years. It constituted only 47.4% of the NSDP in 1993-94 but has increased to 57.7% in 2002-03 (Table 2); correspondingly the shares of primary and secondary sectors have declined from 21.3% to 16.4% and 31.3% to 25.8%, respectively, during the period. Thus, the share of primary sector in the State economy, on which about two-third of the State’s population depends for its livelihood, has got marginalized over the years, Table 1 shows that about 46% of the tertiary sector income in the State comes from the Konkan region, and Gr. Mumbai alone accounts for about 32% of this sector. The four highly urbanized districts, with metropolitan cities, Gr. Mumbai, Thane, Pune and Nagpur together have accounted for more than 55% of the tertiary sector income in the State over the years. The share of Gr. Mumbai, Thane, Pune and Nagpur in the tertiary sector income was 32.0%, 9.8%, 8.1% and 5.4%, respectively, in 1993-94 and 31.6%, 10.6%, 8.3% and 4.9%, respectively, in 2002-03. Among the metropolitan centers, the worst position is that of Nagpur. Its location in economically backward area/ region and far off from Mumbai has led to the stagnation of its share in the State economy. In fact, declining share of tertiary sector income and the stagnating share of its population tell a lot about this. Although, dispersal of secondary sector activities from Gr. Mumbai, Thane and Raigad has led to the marginal increase in Nagpur’s share in the State’s secondary sector income, this gain of the district is not unique as many other districts, albeit backward, have also benefited from this dispersal/flight of industries. The least developed district in terms of tertiary sector per capita income has been again Gadchiroli. As expected, regional order in development of tertiary sector has been that of Konkan, followed by Western Maharashtra, Vidarbha and Marathwada, and this order has remained unchained over the study period.

In contrast to tertiary sector, the share of the four highly urbanized districts in the State in secondary sector has experience marginal decline. Their collective share of 59.0% in 1993-94 has declined to 58.3% in 2002-03. However, regional ranking in secondary sector per capita income is the same as that of tertiary sector and total per capita income.

Increasing marginalization of Primary sector, of which major component is agriculture, is a matter of concern. About two-third of the State population depends on this sector, yet the sector account for about 1/6th of the NSDP. Not only the share of primary sector has declined over the years at the State level but also in all the regions (Table 2). It is not only the diminishing share of primary sector which is a cause of concern but in absolute terms as well the per capita income originating from this sector has declined at the State level and in all the regions, except in Western Maharashtra. Per capita income originating from this sector was Rs.2,624 in 1993-94 at the State level, which declined to Rs.2,544 in 2002-03. In Konkan, Marathwada and Vidarbha, it has declined from Rs.1,299, Rs.2,994 and Rs.3,564 to Rs.940, Rs.2,762, and Rs.3,063, respectively, during the same period. Western Maharashtra and all its districts (except Dhule) have experienced increase in primary sector per capita income. In the region, per capita income from this sector has increased from Rs.2,782 to Rs.3,274 during the above-mentioned period, albeit the share of the sector in the regional total income has declined from 26.9% to 23.0%. The major reason behind this success of Western Maharashtra is development of irrigation in this region, and this has led to the high agricultural development. Vidarbha ranked first in terms of per capita income from primary sector in 1993-94 followed by Marathwada, Western Maharashtra and Konkan, but in 2002-03 Western Maharashtra has taken over the first rank and is followed by Vidarbha, Marathwada and Konkan. Overall decline of this sector in Gadchiroli and agricultural decline in Sindhudurg has led to the drastic fall in the ranks of these districts in terms of per capita income from this sector. The rank of these two districts has gone down from 1st and 2nd in 1993-94 to 25th and 11th , respectively, in 2002-03.

Table 3 presents annual compound growth rate (%) of per capita real income for the State and its regions, divisions and districts. At the aggregate level, the per capita income in the State during the period 1993-94 – 2002-03 has grown by 2.57% per annum. In the State, Western Maharashtra has been the only region, which has experienced growth rate above the State average (3.62% per annum). It is also noteworthy that in none of the districts in Western Maharashtra, the growth rate has been lower than the State average. In growth rate of total per capita income, Western Maharashtra ranks 1st (3.62% per annum) and is followed by Vidarbha (2.18%), Marathwada (1.88%) and the Konkan (1.78%). Three districts, namely, Gadchiroli, Raigad and Sindhudurg have experienced negative growth in their total per capita income because of the above-mentioned reasons. The negative growth rate in these districts during the period has been –6.47%, -2.57% and –0.40% per annum, respectively.

[Table 3 about here]

In comparison to growth rate of 0.41% per annum of the secondary sector per capita income, the tertiary sector per capita income in the State has experienced growth rate of 4.83% per annum. In tertiary sector as well, Western Maharashtra has maintained its lead and is followed by Vidarbha, Konkan and Marathwada (Table 3). None of the districts in the State has experienced negative growth rate of per capita income from this sector. Konkan has experienced industrial decline over the years and per capita income from this sector in the region has declined by –1.78% per annum. All the three major districts in region, the Gr. Mumbai (annual growth rate -0.32%), Thane (-3.26%) and Raigad (-6.92%) have experienced negative growth rates. Outside Konkan, the only other district experiencing negative growth rate in per capita income from this sector has been Aurangabad (-0.48%). In the growth rate of secondary sector per capita income, Vidarbha

(2.36%), Western Maharashtra (2.32%) and Marathwada (1.70%) have occupied first, second and third ranks, respectively.

Primary sector per capita income in the State during 1993-94 – 2003-04 has declined at the rate of –0.34% per annum, and except the Western Maharashtra, all the regions have experienced negative growth rate. The negative growth rates in Konkan, Marathwada and Vidarbha have been of the order of –3.53%, -0.89% and -1.65% per annum, respectively. Out of the 30 districts in the State, 17 districts have experienced the negative growth rate in primary sector per capita income. The highest being in Gadchiroli (-14.34%) followed by Sindhudurg (-9.21%), Ratnagiri (-4.01%) and Aurangabad (-3.11%). In contrast to the negative growth rate in other regions, the per capita income from this sector in Western Maharashtra has experienced an annual growth rate of 1.83% (2.13% in Pune Division and 1.44% in Nashik Division). The negative growth rate of primary sector income in most of the backward districts does not auger well for regionally balanced and socio-politically sustainable development in the State. As mining, forestry, as well as fishery resources are depleting fast, on which these backward districts were dependent, there is a need to put a high emphasis on agricultural development in these districts. In this regard, Western Maharashtra model of agricultural development (led by irrigational development) can be an effective model for economic development of these districts. Development of agricultural sector would lead to increase in income, which would ensure education and skill formation in general masses. The rise in income and skill level can lead to attraction of industries in these area and development of other non-farm sectors. In this way all the sectors of the economy can cumulatively and synergetically evolve, leading to over all high economic and social development in the districts/ regions.

IV. Spatial Association and Inequality

Moran Scatter plots for the total as well as the sectoral per capita incomes of the districts in the State are given in Figures 1.A through 1.H. The Figures show strong positive spatial association in economic development in the State. In fact, global Moron's I for all the sectors establishes this fact (Table 4). The strong spatial association shows that high-developed districts are lying in geographically contiguous area or beside one another. This indicates strong regional inequality in economic development in the State. Table 5 presents frequency distribution of locations of districts in different quadrants of Moran Scatter plots of all the districts for all the three sectors as well as total per capita income together. High frequency of location of districts of Marathwada and Vidarbha in Quadrant III indicates a contiguous geographical area of underdevelopment and deprivation. And high frequency of location of districts of Konkan and Western Maharashtra in Quadrant I shows relatively high development in the regions. The location of Gr. Mumbai, Thane, and Raigad in Quadrant III is because of low development of primary sector and due to that they have frequency of 10 each, equal to the number years of data used in the analysis.

[Fig.1 about here]

Along with Global Moron's I, Table 4 also provides Gini coefficient, coefficient CV and Theil's global as well as decomposed inequality indices. All the inequality indices show that there has been only a very marginal decline in district level inequality in total as well as tertiary sector per capita income in the State. However, decline of inequality in primary and secondary sector per capita income has been more significant. What is obvious from the indices given in Table 4 is that there has not been smooth decline in the inequality in per capita income but it has fluctuated over the years in case of the aggregate as well as the sectoral incomes.

[Table 4 & 5 about here]

Decomposed Theil's inequality index shows that till 1998-99, interregional inequality (read as inter-divisional inequality, as division wise data is used for this) accounted for the major proportion of the 'global' inequality. However, after that the contributions of inter-regional and intra-regional inequality in the 'global' inequality have become almost equal. Intra-regional inequalities are main cause of inequality in primary sector income. While in secondary sector, intra-regional and inter-regional inequalities contribute almost equally to the global inequality. Global inequality in tertiary sector income has been high due to intra-regional inequality, but over the years the gap between both the inequalities has narrowed down due to decline in intra-regional inequality and increase in inter-regional inequality. However, intra-regional inequality still remains high. It is interesting to note that inter-regional inequality in primary and tertiary sector has risen over the years, while its counterpart intra-regional inequality has declined. This indicates that greater divisional homogeneity in development of these two sectors is emerging in the State. Increase in Global Moron's I points out increased spatial association in tertiary sector and secondary sector income. However, at the aggregate level, spatial association has steadily weakened since 1997-98, indicating weakening of the nearest-neighbour bond in similarity of development in recent years.

V. Regional Convergence and Spatial Spillover of Income.

Regression of cross-sectional regional inequality in per capita income (co-efficient of variation of log of per capita income in our case) on time is called σ-convergence analysis. If the estimated regression coefficient is negative, the regions are said to be converging and vice-versa. The σ-convergence results presented in Table 6 show that at sectoral level the convergence coefficient though not very high, but are statistically significant at 5% level of significance. However, the convergence coefficient for total/aggregate per capita income is significant only at about 10% level. The speed of convergence of districts is highest in case of the secondary sector, followed by primary and tertiary sectors.

[Table 6 about here]

With the help of OLS method and other spatial econometric methods, an attempt has been made to measure *β*-convergence of sectoral and aggregate per capita income of the districts in the State. After statistical check and evaluation, the best results are reported in Table 7. Robust LM-Lag test suggests that OLS model for aggregate per capita income suffers from spatial lag autocorrelation. Therefore, inclusion of spatial lag value in the model has been done to overcome this problem. Akaike Information Criterion and R^2 also indicate that the *Spatial Lag Model* is relatively best model for aggregate per capita income data. The rate of beta-convergence of districts income has been statistically significant indicating that homogeneity in economic development in the district is emerging. The implied annual rate of β-convergence of aggregate income is 2.6%. This means that, on an average, it will take about 27 years to close one-half of the gaps between any district's initial level of per capita income and common long term per capita income of all the districts.

[Table 7 about here]

β-convergence for all the sectoral incomes is also statistically significant. While the best regression models for primary and secondary sector incomes is OLS, it is spatial error model, which gives the best result for the tertiary sector income. The highest implied annual rate of beta-convergence is found for the primary sector income (convergence rate 4.6%), followed by the secondary (2.8%) and tertiary sector (1.7%) incomes. This means that these sectors would take about 15 years, 25 years and 41 years respectively for half of the distance between the initial level of income and the sector specific steady-state levels to vanish (Fischer and Stirbock, 2004).

This finding of convergence (σ and β) is noteworthy in the context that many studies, using State level data in the country, have shown divergence of regions in per capita income rather than convergence (Dasgupta et.al., 2000; Ghosh, et.al., 1998; Marjit and Mitra, 1996; Raman, 1996; Shaban, 2002). This shows that regional economies evolve in multiple ways. At one level or scale, they may be converging (diverging or maintaining the same level of inequality), while at another scale, they may be diverging (converging). In fact, it is the scale of study (macro, meso or micro region), which matters the most in convergence analysis as it influences the results and conclusions.

It is possible that within State of Maharashtra some geographically contiguous group of districts may converge at higher rate than the other groups, or there may be group of districts which may be diverging instead of converging, thus forming convergence/divergence clubs. The global regression coefficients reported in Table 7 are not able to capture this. Therefore, geographically weighted regression method, which provides convergence coefficient for all the districts, is used for this purpose.

Figures 2.A through 2.D show choropleth maps of local regression/ convergence coefficient of districts of total as well as sectoral per capita income. The regression coefficients have been classified using Jenk's method of classification/ clustering. This method identifies breakpoints between classes using a statistical formula (Jenk's optimization). It minimizes the sum of the variance within each of the classes and finds groupings and patterns inherent in data. This method of classification is highly efficient and reveals regional structures. The maps show that though all the districts in the State have experienced convergence (as they have negative regression coefficients), there are marked 'convergence clubs' of districts in aggregate as well sectoral per capita income. In total per capita income, districts of Eastern and Central Vidarbha show high β-convergence rate, while districts of Western Vidarbha, Northern Konkan along with Pune, Osmanabad and Solapur have relatively low level of convergence. A geographically contiguous area comprising of North Western Maharashtra (Nashik Division) and Akola and Beed districts show very low level of convergence.

[Fig.2 about here]

In the primary sector, the per capita income for eastern and central Vidarbha again show relatively higher rate of convergence. Southern Maharashtra (South Western Maharashtra and South Marathwada) shows moderate level of convergence, while least level of convergence is found for the districts of Nashik Division. β-convergence in secondary sector per capita income is higher in districts of Konkan and South Western Maharashtra. Central Maharashtra has moderately high rate of convergence, while the least rate of convergence is found in eastern Vidarbha, and southern Marathwada.

In case of the tertiary sector, the per capita incomes in districts of Vidarbha, particularly Northern Vidarbha is converging at higher rate than the rest of the districts in the State. Konkan along with Kolhapur seems to be evolving together at moderate β-convergence rate, while the least rate of convergence is in Marathwada. The GWR results show that there is no spatial stability in regression coefficients but marked presence of heterogeneity in convergence, which was well masked by global β-convergence coefficients.

The presence of significant spatial error dependence in tertiary sector per capita income implies that the random shocks to a specific district would be propagated throughout the State. This is illustrated in Fig 3.A through 3.D, where we introduce shocks (equal to two times the standard error of the estimated spatial error specification) to the error terms for the four districts viz. Gr. Mumbai, Pune, Nagpur and Parbhani, and substituted the maximum likelihood estimates of the spatial error model coefficient into Equation (12) to estimate the degree of spill–over.

The selection of Gr. Mumbai, Pune and Nagpur for the simulation is based on their regional demographic and economic prominence, while Parbhani was selected due to its interior location amidst under developed districts. As expected, the shocks equal to two times of the standard error have highest impact on the districts they are applied to. Due to the shocks, the growth rates of tertiary sector per capita income over the period 1993-94 – 2002-03 in Gr. Mumbai, Pune, Thane and Parbhani become about 15%, 11%, 12% and 9% higher than the estimates without the shocks to these districts. There are clear spatial pattern of propagation of these shocks to other districts. The immediate neighbours of the districts, which are given shocks, experience higher change in the growth rate, while the magnitude of shock/spill-over dampness as distance from the focus increases. The simulation shows that shock (investment) in the district of Parbhani would be more beneficial for the balanced regional development, as spill-over due to the shock to the districts are propagated mostly to the under-developed districts.

[Fig.3 about here]

VI. Summary and Conclusions

The present paper analyses the growth and distribution of sectoral and aggregate incomes in ten years period (1993-94 to 2002-03) in various regions of State of Maharashtra. It is found that notwithstanding its overall high economic development, the State of Maharashtra suffers from acute regional inequality. About a half of the total income in the State is accounted for only by the Konkan region, comprising of districts of Gr. Mumbai, Thane, Raigad, Sindhudurg, and Ratnagiri. After the Konkan, Western Maharashtra is the next highest developed region and is followed by Vidarbha and Marathwada. Four highly urbanized districts of Gr. Mumbai, Thane, Pune and Nagpur also account for about one-half of the total State income, and about 60% of tertiary sector income. This shows that the State economy has become highly metropolitised.

The composition of State income has changed much more in favour of the tertiary sector, which presently accounts for about 60% of the NSDP, while primary sector has got further marginalized, accounting for less than 13% of the total income in the State in the recent years. Significantly, about two-thirds of the State's population directly depends upon the primary sector for its livelihood. Therefore, the marginalization of the primary sector is the marginalisation of two-thirds population of the State. Not only the share of primary sector has gone down in different regions over the years but in absolute term as well it has declined. The stagnated forestry, mining and fishing has mainly led to the decline in primary sector per capita income. It was expected that the development of agriculture would compensate the losses (depletion of forest, mineral and fishing resources), however, it has not been so except in the Western Maharashtra. One major spatial transformation, which the State economy has experienced, is in the secondary sector: the industries, which concentrated in Mumbai-Thane belt, have moved to other regions of the State (as well as out of the State).

There has been marked Stability in the ranking of regions in economic developments over the years in almost all the sectors. Konkan region has been the highest developed region, followed by the Western Maharashtra, Vidarbha and Marathwada.

The growth of regional economies in the State is mainly led by the tertiary sector. The share of secondary sector is stagnating while that of the primary sector has been declining. In comparison to 1993-94, the inequality in per capita district income (aggregate as well as sectoral) has declined in 2002-03. However, inequality in the secondary sector per capita income is higher than other sectors and the aggregate income, albeit the inequality in this sector has declined higher than the other sectors.

Conventional econometric (regression) methods have often been used to find out β-convergence of regional incomes. However, the conventional econometric methods used for spatial data often yield imprecise or wrong results as spatial data are seldom stationary. To overcome this problem, the present study has used spatial econometric techniques to estimate coefficients for β-convergence wherever needed.

Districtwise sectoral and total per capita incomes in the State show σ and β-convergence. The local regression coefficients show marked presence of 'convergence clubs'. The convergence is relatively higher in districts of Vidarbha in the primary, tertiary and aggregate per capita income, while in case of the secondary sector income, it is higher in the Konkan and Western Maharashtra regions. District level sectoral as well as aggregate per capita income data show marked spatial association and so the spatial spill-over and contagion effects. However, this contagion effect is higher in the central Maharashtra than others, meaning thereby that shocks given in some regions are able to significantly affect larger number of districts. Shock to Parbhani due to its central location significantly affects larger number of districts than the shocks to other districts. This differential spatial spill-over process of the same level of shocks at various locations in the State has implication for planning and development. The findings show that giving boost to economies of interior and backward district like Parbhani, instead of Gr. Mumbai, Pune or Nagpur, would be more beneficial for balanced regional development of the State, as beneficial effects generated due to the shocks are propagated mainly to backward districts. The study shows that it is likely that most of the benefits due to investment and development in Gr. Mumbai and Pune would remain concentrated in the Konkan and Western Maharashtra region, already relatively high developed regions in the State.

Acknowledgement

The author is thankful to R.N. Sharma for helpful comments on the paper.

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Table 1: Regional Share (%) in Sectoral and Total NSDP (at 1993-94 prices) and Population in Maharashtra.

Regions	Population		Primary Sector		Secondary Sector		Tertiary Sector		Total	
	1993-94	2002-03	1993-94	2002-03	1993-94	2002-03	1993-94	2002-03	1993-94	2002-03
Greater Mumbai	12.5	12.3	1.5	2.2	29.8	27.3	32.0	31.6	24.8	25.7
Thane	6.7	8.7	2.7	2.8	13.9	12.8	9.8	10.6	9.6	9.9
Raigad	2.3	2.3	2.0	1.7	8.4	4.2	1.6	1.7	3.8	2.4
Ratnagiri	1.9	1.7	2.7	1.7	1.0	1.3	1.1	1.2	1.4	1.3
Sindhudurg	1.0	0.9	3.3	1.2	0.4	0.5	0.7	0.7	1.1	0.7
I. Konkan Div/Region	**24.6**	**25.8**	**12.2**	**9.5**	**53.5**	**46.1**	**45.1**	**45.9**	**40.7**	**40.0**
Nashik	4.9	5.1	6.2	7.4	4.8	5.4	3.3	3.6	4.4	4.7
Dhule	3.2	3.1	2.8	2.5	1.0	1.2	1.8	2.0	1.8	1.9
Jalgaon	4.0	3.8	4.8	5.7	1.9	1.8	2.5	2.8	2.8	3.0
Ahmadnagar	4.3	4.2	3.8	4.9	2.2	2.4	2.6	2.7	2.7	3.0
II. Nashik Division	**16.4**	**16.2**	**17.6**	**20.5**	**9.8**	**10.7**	**10.3**	**11.1**	**11.7**	**12.5**
Pune	7.0	7.5	5.4	7.5	11.5	13.8	8.1	8.3	8.6	9.6
Satara	3.1	2.9	3.6	4.5	1.5	2.0	1.9	2.1	2.2	2.5
Sangli	2.8	2.6	3.9	4.6	1.4	1.8	2.3	2.2	2.4	2.5
Kolhapur	4.1	3.6	5.1	6.0	2.8	3.4	3.3	3.3	3.5	3.8
Solapur	3.8	4.0	3.7	4.4	2.1	2.6	3.0	2.9	2.9	3.1
III. Pune Division	**20.8**	**20.6**	**21.8**	**27.0**	**19.4**	**23.6**	**18.6**	**18.8**	**19.5**	**21.4**
Western Maharashtra (II+III)	**37.2**	**36.8**	**39.4**	**47.5**	**29.2**	**34.3**	**28.8**	**29.9**	**31.2**	**33.9**
Aurangabad	2.8	3.1	2.5	2.1	3.2	3.2	2.0	1.9	2.5	2.3
Jalna	1.7	1.7	2.2	2.0	0.4	0.6	0.8	0.8	1.0	0.9
Parbhani	2.7	2.5	3.8	3.6	0.7	0.8	1.5	1.4	1.8	1.6
Beed	2.3	2.2	2.9	3.1	0.6	0.8	1.3	1.2	1.4	1.4
Nanded	3.0	3.0	2.8	2.7	1.0	1.1	1.8	1.6	1.8	1.7
Osmanabad	1.6	1.5	2.1	1.7	0.4	0.5	0.7	0.7	0.9	0.8
Latur	2.1	2.2	2.2	2.3	0.6	0.7	1.3	1.1	1.3	1.2
IV. Aurangabad Div./Marathwada (IV)	**16.3**	**16.1**	**18.5**	**17.5**	**6.9**	**7.7**	**9.4**	**8.7**	**10.6**	**9.9**
Buldhana	2.4	2.3	2.5	2.2	0.6	0.7	1.6	1.4	1.5	1.3
Akola	2.8	2.7	3.2	3.0	0.9	1.1	2.3	1.9	2.0	1.9
Amravati	2.8	2.7	4.5	3.4	0.9	1.0	2.0	2.0	2.2	2.0
Yavatmal	2.6	2.5	3.6	3.7	0.8	0.9	1.5	1.4	1.7	1.7
V. Amravati Division	10.6	10.2	13.8	12.4	3.1	3.7	7.3	6.6	7.4	6.8
Wardha	1.3	1.3	1.6	1.8	0.5	0.6	0.9	0.9	0.9	1.0
Nagpur	4.2	4.2	3.8	4.5	3.8	4.4	5.4	4.9	4.6	4.7
Bhandara	2.7	2.4	3.2	2.3	1.3	1.5	1.2	1.4	1.7	1.6
Chandrapur	2.2	2.1	4.2	3.7	1.4	1.4	1.4	1.3	2.0	1.8
Gadchiroli	1.0	1.0	3.3	0.8	0.2	0.2	0.4	0.4	1.0	0.4
VI. Nagpur Division	**11.4**	**11.0**	**16.1**	**13.1**	**7.3**	**8.2**	**9.3**	**8.9**	**10.1**	**9.4**
Vidarbha (V+VI)	**22.0**	**21.2**	**29.9**	**25.5**	**10.4**	**11.9**	**16.6**	**15.6**	**17.5**	**16.2**
Maharashtra	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Note: NSDP data for 2002-03 are provisional.

Source: Computed data obtaned from Directorate of Economics and Statistics, Government of Maharashtra, Mumbai.

Table 2: Sectoral Shares and Regional Per Capita Income (at 1993-94 prices) in Maharashtra, 1993-94 & 2002-03.

	Region / District	Sectoral Share (%) in Total Regional/District Income						Ranks of the Districts based on Per Capita Income						Total/Aggregate Per Capita Income (Rs.)			
		Primary Sector		*Secondary Sector*		*Tertiary Sector*		*Primary Sector*		*Second. Sector*		*Tertiary Sector*					
		1993-94	2002-03	1993-94	2002-03	1993-94	2002-03	1993-94	2002-03	1993-94	2002-03	1993-94	2002-03	1993-94	Rank	2002-03	Rank
1	Greater Mumbai	1.3	1.4	37.6	27.5	61.1	71.1	30	30	2	1	1	1	24,382	1	32,402	1
2	Thane	6.0	4.7	45.4	33.6	48.6	61.7	29	29	3	4	2	2	17,521	3	17,569	3
3	Raigad	11.1	11.6	69.0	45.7	19.9	42.7	27	27	1	3	11	8	20,245	2	16,009	6
4	Ratnagiri	41.0	21.3	22.8	25.2	36.3	53.6	7	20	10	9	26	14	8,868	15	11,850	15
5	Sindhudurg	61.5	26.7	69.0	16.6	28.2	56.7	2	11	18	16	14	7	13,480	6	13,010	10
I	**Konkan Division/ Region**	6.4	3.9	41.1	29.8	52.6	66.3	IV	IV	I	I	I	I	20,424	I	23,938	I
6	Nashik	29.9	26.1	34.0	29.7	36.1	44.2	12	8	6	6	12	15	11,050	9	14,092	8
7	Dhule	34.0	21.9	16.8	16.4	49.2	61.7	26	26	22	21	22	17	6,796	30	9,344	24
8	Jalgaon	36.3	30.9	21.0	15.3	42.7	53.8	16	5	16	18	16	10	8,605	19	12,343	13
9	Ahmadnagar	29.6	27.0	25.6	20.8	44.8	52.2	25	14	11	15	21	18	7,868	22	10,920	18
II	**Nashik Division**	32.0	26.8	26.3	22.2	41.7	51.0	--	--	--	--	--	--	8,787	--	11,918	--
10	Pune	13.4	12.8	42.0	37.2	44.5	50.0	28	21	4	2	4	4	15,058	4	19,685	2
11	Satara	35.5	30.1	22.3	20.9	42.2	49.0	17	4	13	10	17	11	8,632	17	13,416	9
12	Sangli	35.7	30.1	18.5	18.2	45.8	51.7	6	1	15	12	7	6	10,361	12	14,676	7
13	Kolhapur	30.8	26.1	24.8	23.2	44.5	50.6	8	3	8	8	5	5	11,567	8	16,210	5
14	Solapur	27.8	23.7	23.1	22.0	49.0	54.3	22	17	12	13	8	13	8,628	18	11,958	14
III	**Pune Division**	23.8	20.7	31.1	28.5	45.1	50.8	--	--	--	--	--	--	11,573	--	16,079	--
	Western Maharashera (II+III)	26.9	23.0	29.3	26.1	43.8	50.9	III	I	II	II	II	II	10344	II	14243	II
15	Aurangabad	21.8	15.4	40.4	36.4	37.7	48.2	24	28	5	7	10	20	10,789	11	11,494	16
16	Jalna	46.9	35.0	12.9	16.4	40.3	48.6	11	13	28	24	27	29	7,077	28	8,691	27
17	Parbhani	46.1	37.2	12.9	13.6	41.0	49.2	5	9	25	26	23	26	8,110	20	9,732	23
18	Beed	43.3	36.3	13.7	14.7	43.0	49.0	13	10	26	23	25	25	7,526	24	9,760	22
19	Nanded	33.9	26.5	17.6	17.6	48.5	55.9	21	24	19	20	19	24	7,304	27	8,691	27
20	Osmanabad	49.0	34.1	13.2	15.3	37.8	50.7	10	15	27	27	29	28	7,063	29	8,463	29
21	Latur	36.9	31.3	15.1	14.6	47.9	54.1	20	19	24	28	20	27	7,376	26	8,561	28
IV	**Aurangabad Division / Marathwada Region**	37.3	29.1	20.5	20.2	42.2	50.7	II	III	IV	IV	IV	IV	8,035	IV	9,496	IV
22	Buldhana	37.3	27.3	12.0	13.4	50.7	59.3	19	22	29	29	15	21	7,485	25	8,938	25
23	Akola	33.1	26.7	13.6	15.0	53.3	58.3	18	16	20	19	6	16	8,992	14	10,639	19
24	Amravati	44.2	28.7	12.6	13.4	43.2	57.9	4	12	21	22	9	12	9,610	13	11,337	17
25	Yavatmal	44.7	37.0	14.3	13.5	41.0	49.5	9	6	23	25	24	23	7,957	21	10,128	21
V	**Amravati Division**	39.9	29.9	13.2	13.9	47.0	56.3	--	--	--	--	--	--	8,558	--	10,314	--
26	Wardha	36.4	29.8	17.7	16.4	45.8	53.7	15	7	17	17	13	9	8,642	16	12,359	12
27	Nagpur	17.6	15.9	26.3	24.3	56.1	59.9	23	18	7	5	3	3	13,504	5	17,346	4
28	Bhandara	40.8	23.7	24.5	25.0	34.7	51.3	14	23	14	14	28	22	7,858	23	10,194	20
29	Chandrapur	45.0	34.4	22.0	21.3	32.9	44.4	3	2	9	11	18	19	10,912	10	12,752	11
30	Gadchiroli	73.3	33.2	6.8	14.9	19.9	51.9	1	25	30	30	30	30	11,784	7	6,453	30
VI	**Nagpur Division**	33.8	22.9	22.6	22.6	43.6	54.6	--	--	--	--	--	--	10,952	--	13,332	--
	Vidarbha Region (V+VI)	36.4	25.8	18.6	18.9	45.0	55.3	I	II	III	III	III	III	9,801	III	11,876	III
	Maharashtra	21.3	16.4	31.3	25.8	47.4	57.7	--	--	--	--	--		12,326	--	15,484	--

Note: Ranks in the Roman letter are ranks of the regions.

Source: The same as for Table 1.

Table 3: Annual Growth Rate (%) of Per Capita Income (at 1993-94 prices) in Maharashtra, 1993-94 to 2002-03.

	Region / District	Primary Sector		Secondary Sector		Tertiary Sector		Total / Aggregate	
		Growth Rate	Rank	Growth Rate	Rank	Growth Rate	Rank	Growth Rate	Rank
1	Greater Mumbai	4.35	1	-0.32	27	4.96	15.5	3.21	10
2	Thane	-2.72	24	-3.26	29	2.72	30	0.03	27
3	Raigad	-2.10	23	-6.92	30	6.03	7	-2.57	29
4	Ratnagiri	-4.01	28	4.39	3	7.82	1	3.24	9
5	Sindhudurg	-9.21	29	4.95	2	7.65	2	-0.40	28
I	**Konkan Division/ Region**	**-3.53**	**IV**	**-1.78**	**IV**	**4.43**	**III**	**1.78**	**IV**
6	Nashik	1.08	11	1.11	25	4.96	15.5	2.63	16
7	Dhule	-1.33	20	3.28	8	6.24	6	3.60	8
8	Jalgaon	2.25	5	0.53	26	6.78	4	4.09	2
9	Ahmadnagar	2.65	3	1.34	22.5	5.49	9	3.71	6
II	**Nashik Division**	**1.44**	--	**1.50**	--	**5.78**	--	**3.44**	--
10	Pune	2.45	4	1.64	21	4.35	21	3.02	11
11	Satara	3.11	2	4.29	4	6.76	5	5.02	1
12	Sangli	1.97	6	3.77	6	5.33	11	3.93	4
13	Kolhapur	1.96	7	3.09	13	5.32	12	3.82	5
14	Solapur	1.86	8	3.14	12	4.87	18	3.69	7
III	**Pune Division**	**2.13**	--	**2.72**	--	**5.11**	--	**3.72**	--
	Western Maharashtra (II+III)	**1.83**	**I**	**2.32**	**II**	**5.35**	**I**	**3.62**	**I**
15	Aurangabad	-3.11	27	-0.48	28	3.48	27	0.70	26
16	Jalna	-0.96	18	5.10	1	4.47	19	2.31	17
17	Parbhani	-0.35	15	2.63	15	4.14	22	2.05	18
18	Beed	0.96	12	3.78	5	4.45	20	2.95	12
19	Nanded	-0.81	17	1.98	19	3.57	25.5	1.95	21
20	Osmanabad	-2.02	22	3.68	7	5.41	10	2.03	19
21	Latur	-0.19	14	1.28	24	3.05	28	1.67	25
IV	**Aurangabad Division / Marathwada Region**	**-0.89**	**II**	**1.70**	**III**	**3.97**	**IV**	**1.88**	**III**
22	Buldhana	-1.49	21	3.23	9	3.79	24	2.00	20
23	Akola	-0.53	16	2.94	14	2.92	29	1.88	22
24	Amravati	-2.93	25	2.55	16	5.23	13	1.85	23
25	Yavatmal	0.58	13	2.04	17	4.90	17	2.72	15
V	**Amravati Division**	**-1.12**	--	**2.67**	--	**4.17**	--	**2.10**	--
26	Wardha	1.77	9	3.16	11	5.92	8	4.06	3
27	Nagpur	1.63	10	1.89	20	3.57	25.5	2.82	14
28	Bhandara	-3.10	26	3.18	10	7.50	3	2.93	13
29	Chandrapur	-1.27	19	1.34	22.5	5.19	14	1.75	24
30	Gadchiroli	-14.34	30	2.01	18	4.04	23	-6.47	30
VI	**Nagpur Division**	**-2.15**	--	**2.22**	--	**4.78**	--	**2.21**	--
	Vidarbha Region (V+VI)	**-1.65**	III	**2.36**	I	**4.53**	II	**2.18**	II
	Maharashtra	**-0.34**	--	**0.41**	--	**4.83**	--	**2.57**	--

Note : Roman numerals show ranks of the regions.

Source: the same as for Table 1.

Table 4: Regional Inequality in Per Capita Income (at 1993-94 prices) in Maharashtra.

Period	Theil's Inequality			Gini	CV (%)	Moran's I	
	Global	Intra-regional	Inter-regional			Value	*probability (z)*
			A. Aggregate/Total Per Capita Income				
1993-94	0.065	0.026	0.039	0.190	3.491	0.472	0.000
1994-95	0.069	0.025	0.044	0.200	3.672	0.487	0.000
1995-96	0.075	0.028	0.047	0.209	3.805	0.506	0.000
1996-97	0.061	0.029	0.032	0.189	3.436	0.429	0.000
1997-98	0.082	0.030	0.052	0.217	3.936	0.530	0.000
1998-99	0.071	0.030	0.041	0.201	3.598	0.484	0.000
1999-00	0.059	0.030	0.029	0.180	3.294	0.451	0.000
2000-01	0.063	0.031	0.032	0.189	3.495	0.443	0.000
2001-02	0.057	0.029	0.028	0.177	3.246	0.414	0.000
2002-03	0.060	0.031	0.029	0.180	3.324	0.408	0.000
			B. Primary Sector Per Capita Income				
1993-94	0.111	0.098	0.013	0.233	7.085	0.329	0.001
1994-95	0.132	0.120	0.013	0.252	7.274	0.289	0.003
1995-96	0.123	0.105	0.019	0.252	6.908	0.326	0.001
1996-97	0.096	0.085	0.011	0.231	6.381	0.303	0.002
1997-98	0.135	0.107	0.028	0.273	6.827	0.365	0.000
1998-99	0.094	0.084	0.010	0.226	6.199	0.359	0.000
1999-00	0.060	0.041	0.019	0.178	5.792	0.379	0.000
2000-01	0.080	0.062	0.018	0.215	6.321	0.288	0.003
2001-02	0.062	0.043	0.019	0.183	5.775	0.289	0.003
2002-03	0.062	0.043	0.019	0.181	5.967	0.336	0.001
			C. Secondary Sector Per Capita Income				
1993-94	0.378	0.180	0.198	0.452	9.676	0.536	0.000
1994-95	0.351	0.182	0.169	0.441	9.600	0.529	0.000
1995-96	0.366	0.185	0.181	0.455	9.910	0.526	0.000
1996-97	0.299	0.157	0.142	0.416	8.981	0.502	0.000
1997-98	0.321	0.159	0.162	0.427	9.085	0.524	0.000
1998-99	0.316	0.156	0.160	0.424	8.938	0.524	0.000
1999-00	0.231	0.116	0.115	0.372	8.089	0.556	0.000
2000-01	0.230	0.114	0.115	0.367	7.976	0.540	0.000
2001-02	0.216	0.108	0.108	0.357	7.719	0.535	0.000
2002-03	0.202	0.097	0.104	0.348	7.598	0.538	0.000
			D. Tertiary Sector Per Capita Income				
1993-94	0.104	0.069	0.035	0.217	4.440	0.260	0.006
1994-95	0.106	0.070	0.036	0.220	4.480	0.273	0.004
1995-96	0.105	0.062	0.043	0.221	4.438	0.299	0.002
1996-97	0.105	0.069	0.036	0.219	4.405	0.286	0.003
1997-98	0.105	0.068	0.037	0.217	4.326	0.288	0.003
1998-99	0.105	0.067	0.038	0.220	4.342	0.311	0.002
1999-00	0.094	0.053	0.041	0.206	4.090	0.360	0.000
2000-01	0.093	0.052	0.040	0.205	4.076	0.354	0.000
2001-02	0.092	0.052	0.040	0.205	4.035	0.351	0.001
2002-03	0.093	0.052	0.042	0.207	4.040	0.355	0.000

Note: Coefficient of variation (CV), and Moran's I have been computed using log of per capita income.

Source: As in Table 1.

Table 5: Location of Districts in Different Quadrants Based on Moran Scatter Plot of Per Capita Income of All The Three Sectors and Total Per Capita Income Together.

Districts	*Quadrant I*	*Quadrant II*	*Quadrant III*	*Quadrant IV*
Greater Mumbai	30	0	10	0
Thane	30	0	10	0
Raigad	29	1	10	0
Ratnagiri	13	27	0	0
Sindhudurg	23	15	1	1
Nashik	17	10	0	13
Dhule	0	32	8	0
Jalgaon	0	0	24	16
Ahmadnagar	7	24	6	3
Pune	30	0	8	2
Satara	19	18	0	3
Sangli	35	1	1	3
Kolhapur	29	0	0	11
Solapur	14	15	5	6
Aurangabad	0	9	12	19
Jalna	6	0	34	0
Parbhani	5	0	31	4
Beed	6	0	31	3
Nanded	0	9	31	0
Osmanabad	6	0	31	3
Latur	4	5	31	0
Buldhana	0	9	31	0
Akola	3	6	25	6
Amravati	16	0	19	5
Yavatmal	6	4	30	0
Wardha	19	11	9	1
Nagpur	4	7	0	29
Bhandara	8	13	15	4
Chandrapur	11	0	10	19
Gadchiroli	7	13	16	4

Note and Source: As for Table 1.

Table 6: σ-Convergence of Sectoral and Total Per Capita Income in Districts of Maharashtra, 1992-93 – 2002-03.

Parametres	Primary *Sector*	Secondary *Sector*	Tertiary *Sector*	Total
α	7.316 (0.000)	10.237 (0.000)	4.586 (0.000)	3.758 (0.000)
β	-0.158 (0.001)	-0.269 (0.000)	-0.057 (0.000)	-0.041 (0.098)
$\bar{R}^2$	0.740	0.899	0.871	0.217

Notes: *p*-values are in parentheses
Source: The same as for Table 1.

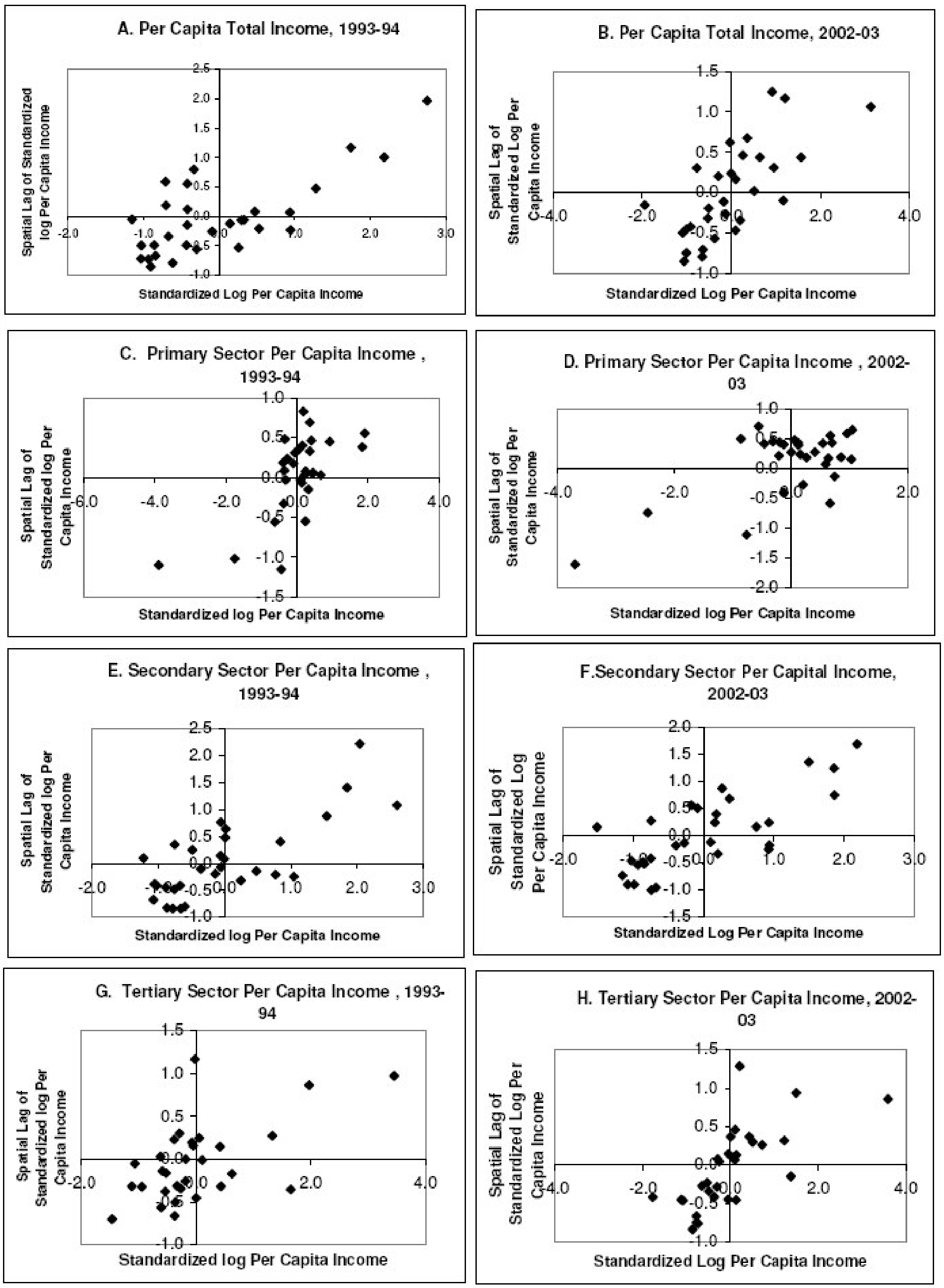
Table 7: Estimates of β-Convergence of Sectoral and Aggregate Per Capita Income of Districts of Maharashtra, 1993-04 to 2002-03.

Parametres	*Primary Sector*	*Secondary Sector*	*Tertiary Sector*	*Total Per Capita Income*	
	OLS	*OLS*	*Spatial Error (ML)*	*OLS*	*Spatial Lag (ML)*
α	2.635 (0.001)	1.853 (0.000)	1.614 (0.005)	2.197 (0.037)	2.363 (0.017)
β	-0.340 (0.001)	-0.220 (0.000)	-0.141 (0.011)	-0.218 (0.055)	-0.232 (0.029)
λ	--	--	0.479 (0.011)	--	--
ρ	--	--	--	--	-0.198 (0.455)
τ	--	--	--	--	--
R^2	0.308	0.562	0.253	0.125	0.148
AIC	14.454	-27.567	-46.851	-11.998	-10.541
Moran's I	0.091 (0.227)	0.063 (0.299)	--	-0.025 (0.812)	--
LM-Lag Test	0.232 (0.629)	0.293 (0.588)	--	0.484 (0.486)	--
Robust LM-Lag Test	0327 (0.566)	2.389 (0.122)	--	4.493 (0.034)	--
LM-Error Test	0.514 (0.473)	2.347 (0.126)	--	0.039 (0.842)	--
Robust LM-Error Test	0.608 (0.435)	2.640 (0.267)	--	4.048 (0.054)	
Implied Convergence Rate (θ)	0.046	0.028	0.017	0.025	0.026
Time taken (in Years) to Complete ½ Distance to the Steady-State	15.07	24.76	40.77	27.73	26.66

Notes: *p*-values are in parentheses. The implied convergence rate θ is calculated as θ = ln(β+1)/-t, where t is the length of time. AIC = Akaike Information Criterion; LM = Lagrange Multiplier Test; The ½ distance to the steady state is computed using formula ln(2)/ θ.

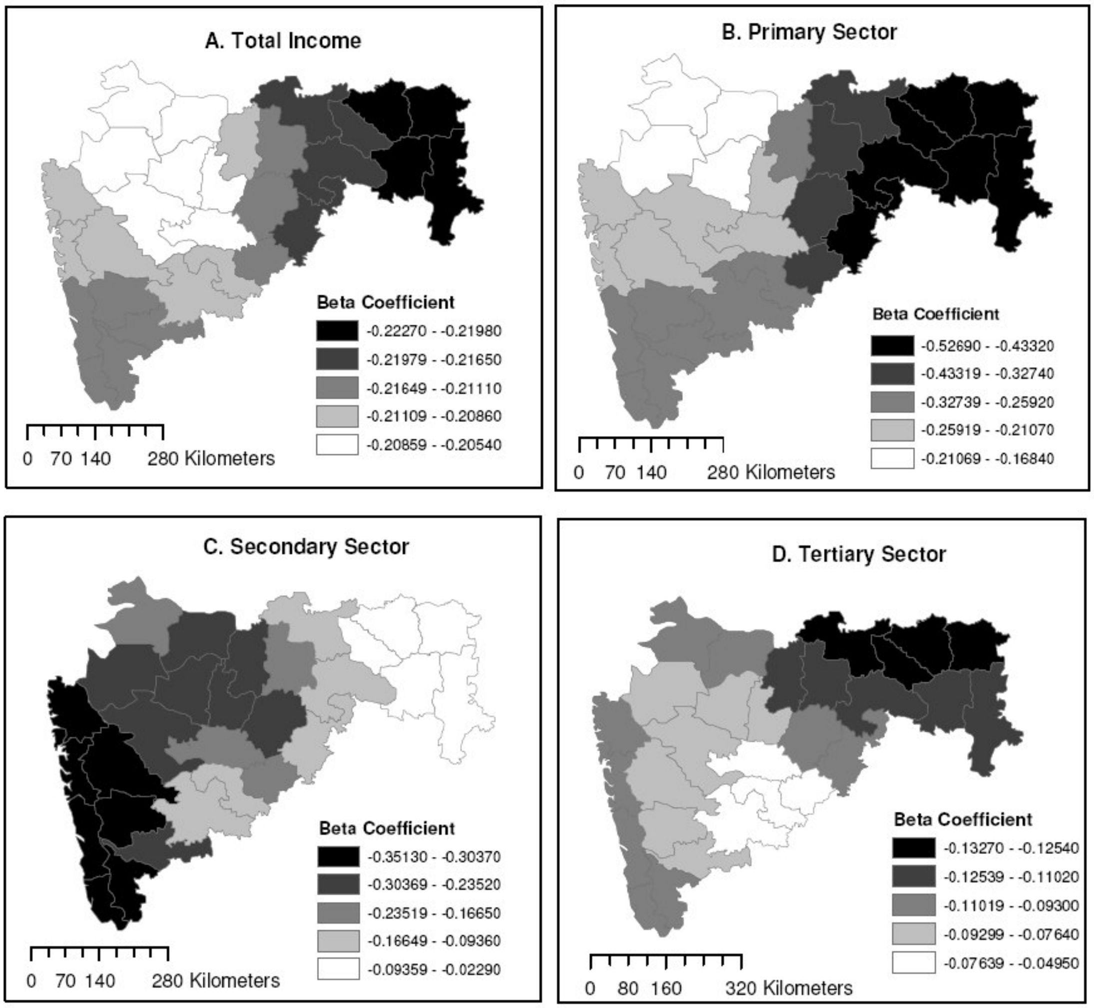
Source: As for Table 1.

Fig.1: Moran Scatter Plots of Total and Sectoral Per Capita Income of Districts in Maharashtra.



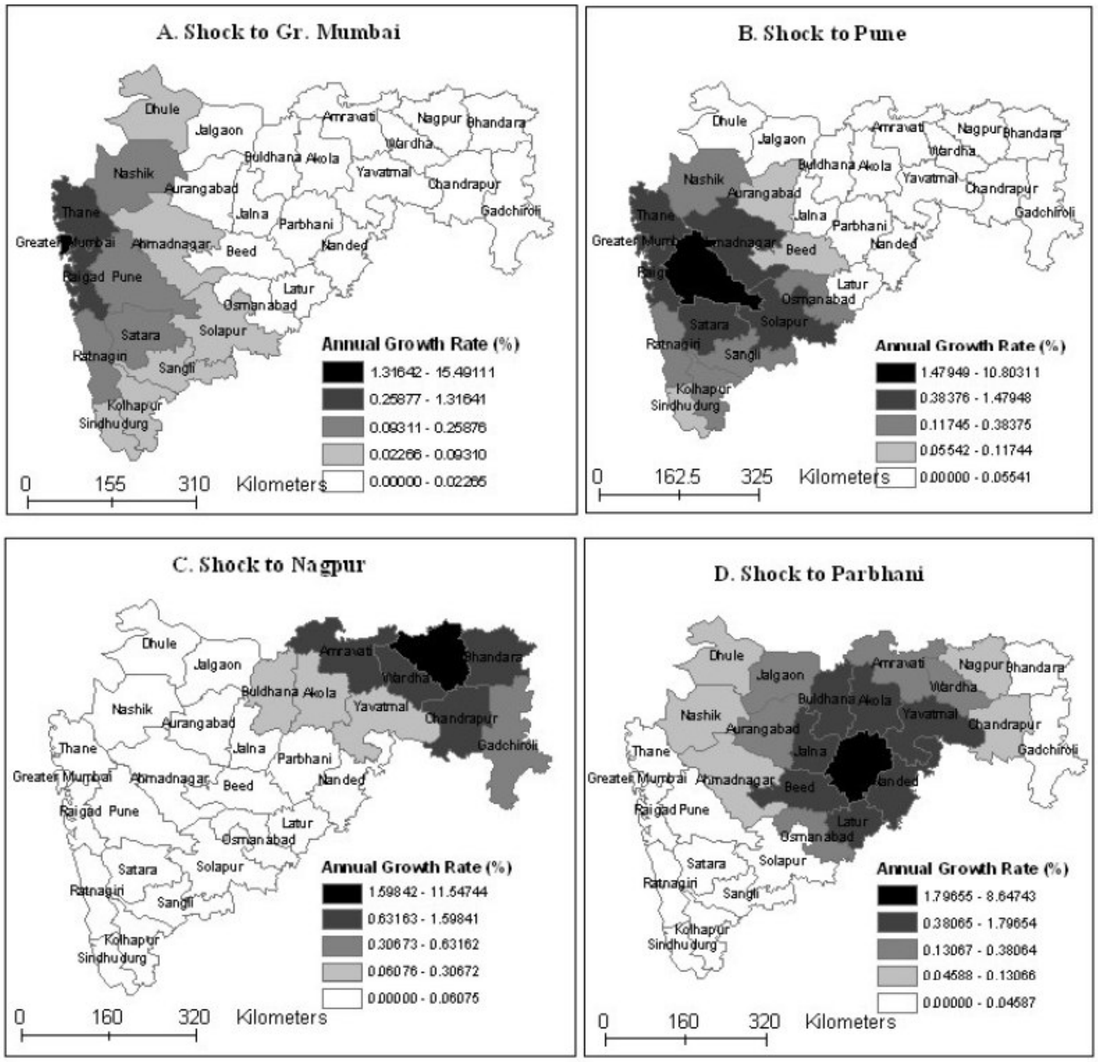
Note and Source: As for Table 1.

Fig. 2: Spatial Diffrences in Beta Convergence of Total and Sectoral Per Capita Income in Maharashtra, 1993-94 - 2002-03.



Note: The classification of beta-coefficients (regression coefficients) for all the above Figures is based on Jenk's method.

Fig. 3: Changes in Annual Growth Rate (%) of Tertiary Sector Per Capita Income Due to Shock to Some Districts in Maharashtra, 1993-94 to 2002-03



Note: The same as for the Fig. 2.